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LESSONS LEARNED FROM DEVELOPING THE ABCS 6.4 SOLUTION

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In response to Army decisions during the 1980s to develop increasingly lethal platforms aided by automation, several automated command and control (C2) systems were developed to support various battlefield functional areas. These C2 systems were successful during Operations Enduring Freedom and Iraqi Freedom; however, each system was evolving independently of the others. In 2003, after the *Good Enough* Army Battle Command Systems (ABCS) decision by Army leaders, Program Executive Office Command, Control, and Communications Tactical initiated a concerted battle command integration effort. The Army designated ABCS version 6.4 software as the standard version to field. This article reviews lessons learned from the systems engineering and integration of ABCS 6.4, moving from *stovepipe* development and testing to an integrated and interoperable System-of-Systems, leading to operational evaluation preparation and fielding.

In order to fight and win wars, the Army must be organized, directed, controlled, supported, and sustained in a manner that guarantees mission accomplishment. The Army of the 21st century combines flexible organizational elements, battle-proven techniques of leadership, and a basic concept of command and control (C2) that combines historical experience and modern information technology. The Army Battle Command System (ABCS) provides commanders the battle command architecture necessary to gain and maintain the initiative and successfully execute missions assigned by the National Command Authority (NCA). The ABCS version 6.4 is the single System-of-Systems (SOS) by which Army forces pass critical operational information to perform missions in support of national objectives. The ABCS 6.4 provides improvements in both flexibility and interoperability over previous C2 systems.

BATTLE COMMAND TOP-DOWN FOCUS

In 2003, the Chief of Staff of the Army (CSA) directed that the Army shift its funding efforts from developing the Battle Command architecture from the bottom-up to one that is focused on developing the architecture from the top-down. Additionally, he directed the fielding capability to the entire Army. Prior to this decision, the entire Army Battle Command suite was only programmed for a fraction of the Army force. This decision redirected resources, stopped development of the ABCS software suite at the current Block IV, and redirected all available funding to fielding a C2 system to the entire force structure.

Development of ABCS is now driven by a top-down approach that will have to take into account joint requirements and communications architecture. The SOS will be designed to allow C2 with data feeds between various command levels, up to and including a Theater-wide Combined Forces Command Center. It will provide a commander enhanced C2 through more automation of staff functions and by moving toward meeting the commander's needs of operating in a joint environment. Not only must it provide C2 capabilities across the Army and facilitate joint interoperability for Army units, it must be affordable for fielding across the entire force.

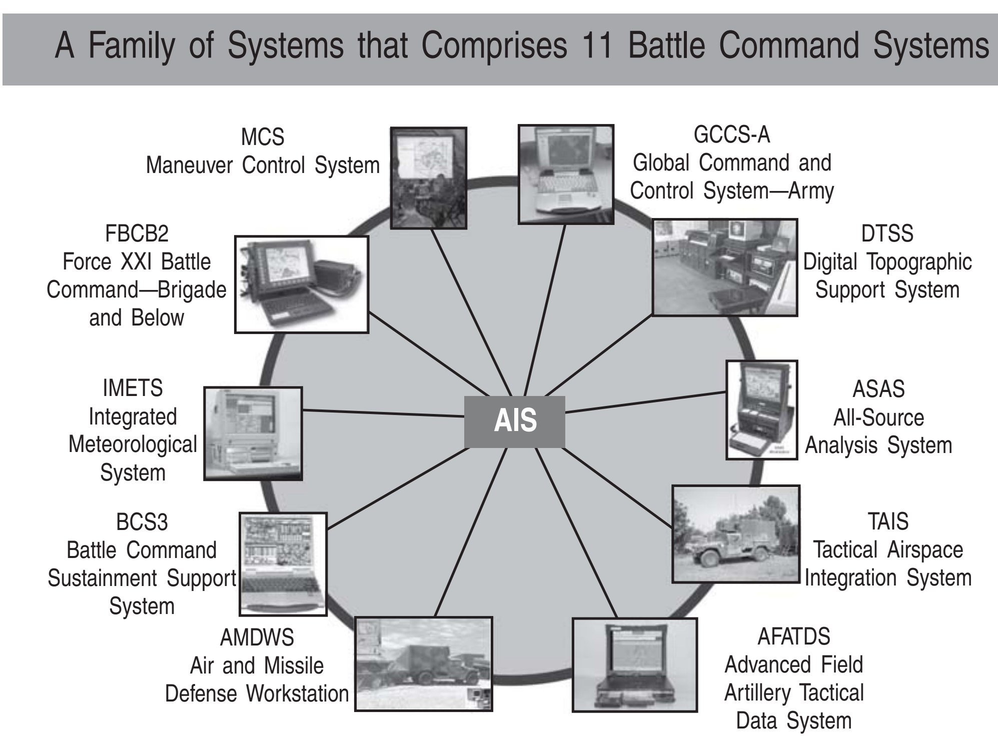

FIGURE 1. ABCS 6.4 *GOOD ENOUGH* SYSTEMS

WHAT IS ABCS 6.4?

The ABCS consists of 11 battlefield automated systems, which comprises the core for ABCS and provides the capabilities that support the warfighter's mission needs (Figure 1). Each Battlefield Automated System (BAS) aids in planning, coordinating, and executing operations by providing access to and the passing of information from a horizontally integrated command and control network. Systems within ABCS support soldiers specializing in a battlefield functional area; for example, maneuver, intelligence, fire support, and logistics. The BAS is grouped into five Battlefield Functional Areas (BFAs)—Maneuver, Fire Support, Air Defense, Intelligence/Electronic Warfare and Battle Command Sustainment Support.

The ABCS 6.4 differs from earlier versions due to the incorporation of the centralized information server. The addition of the ABCS Information Server (AIS) into the Tactical Operations Center (TOC) structure, with its Publish and Subscribe Server (PASS) methodology, enables the horizontal information exchange. The AIS assists the 11 BAS systems to interoperate as one; thus, ABCS is called a system-of-systems.

The ABCS 6.4 is an improvement of the previous command and control system, ABCS 6.3 Delta, but with the additional enhancements necessary to maintain interoperability with the other ABCS, Software Block 1 and Joint C2 systems. It

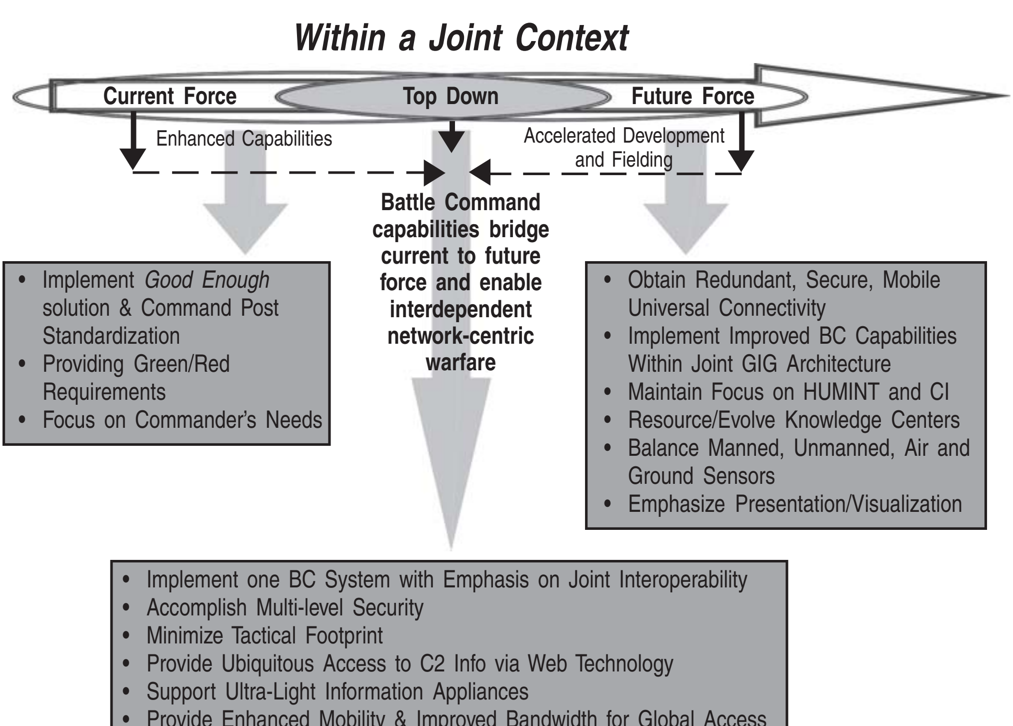

FIGURE 2. EMERGING VISION NET-CENTRIC BATTLE COMMAND

meets the Army's good enough prioritized requirements and provides a net-centric data management capability on a dedicated server. Its program schedule aligns with previous ABCS 7.0 plans, which stopped development at the current ABCS 6.4 version. However, ABCS 6.4 will need further coordination with the joint community to ensure interoperability with joint and coalition forces.

BACKGROUND ON ABCS 6.4

Prior to 1995, several independent projects were underway to leverage the rapid growth in Internet-related technologies and develop systems that improve command and control capabilities in several battlefield functional areas. In 1995, Program Executive Officer Command, Control, and Communications Tactical (PEO C3T), headquartered at Fort Monmouth, NJ, began working with the Training and Doctrine Command (TRADOC), along with elements of the 4th Infantry Division at Fort Hood, TX, to develop the ABCS. The PEO's goal was to join those evolving and developing systems into an SOS concept, to enable horizontal networked integration and interoperability amongst the systems in a common operating environment.

BATTLE COMMAND SYSTEM LESSONS

Initial assessments from units in theater indicated that Force XXI Battle Command Brigade-and-Below (FBCB2) and Blue Force Tracker (BFT) were winners and that e-mail, chat rooms (Instant Messaging), and Web pages were critical for collaboration and information dissemination. Additionally, mobile command posts enabled by satellite communications were critical, given the operational tempo and extended distances. However, development of the correlated red picture did not satisfy tactical requirements. In addition, databases and data exchange mechanisms did not support the frequent task reorganizations—incremental and dynamic naming conventions were required. Also, with the conclusion of initial ground operations, it was evident that Security and Stability Operations (SASO) applications, which enabled full spectrum operations, were a necessity.

CHIEF OF STAFF OF THE ARMY GUIDANCE (AUGUST 2003)

During the summer of 2003, with our Army at war, the PEO C3T's top priority was to expedite the delivery of innovative, integrated, and operationally suitable warfighter capability to the field. The CSA wanted to focus on the commander's operational needs, plus Joint and Coalition Interoperability, which are designated as the *Top 7 plus 1*. They are:

1. Friendly Locations.

2. Current Enemy Situation.

3. Running Estimate (Current Combat Power/Future Combat Power/Staff Estimates).

4. Graphic Control Measures.

5. Fragmentary Orders (FRAGOs).

6. Commander's Situation Report (SITREP).

7. Fire Support Coordination Measures/Capabilities Overlay.

8. Joint and Coalition Interoperability.

ESTABLISHMENT OF AN OVERARCHING INTEGRATED PRODUCT TEAM

The PEO C3T, Major General Michael R. Mazzucchi, designated the Project Manager for Ground Combat and Control, Colonel Greene, as the *trail boss* to lead the effort in rapidly developing an SOS and getting it to the PEO C3T's Central Technical Support Facility (CTSF) at Fort Hood, Texas by April 30, 2004. To jump start the process, Colonel Greene established an ABCS 6.4 good enough Execution

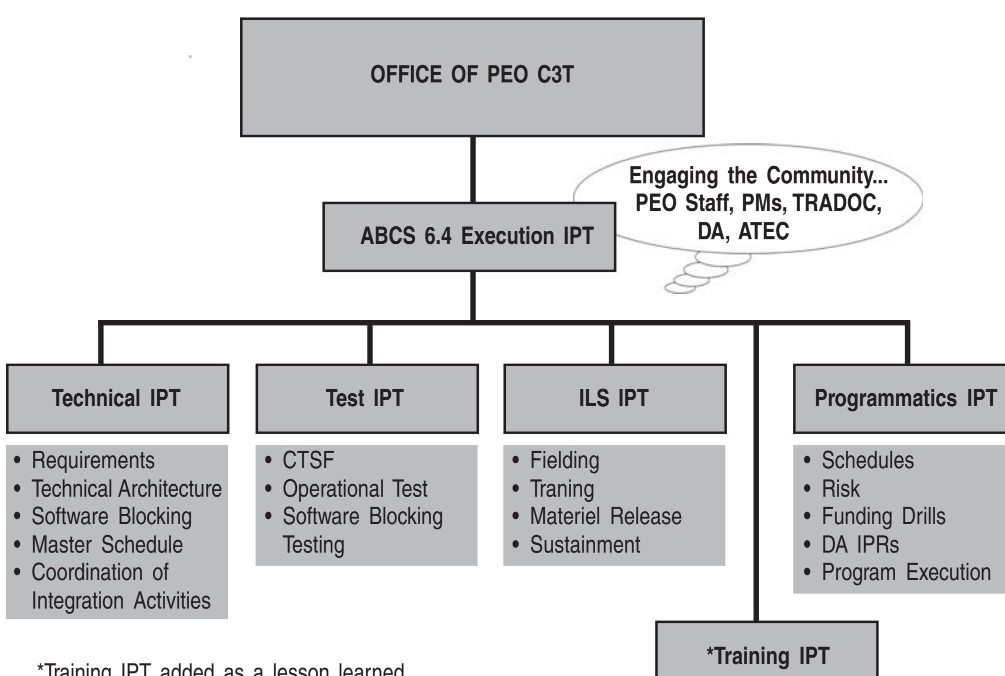

FIGURE 3. PROGRAM EXECUTION

Integrated Product Team (EIPT) for ABCSs that included all Army stakeholders (Figure 3). One of the mandates of the Integrated Product Team (IPT) was to proceed in accordance with the CSA directive to stop development of the ABCS at version 6.4 and refocus efforts and funding toward a top-down architecture that met the Commander's top seven needs plus Joint interoperability.

The ABCS 6.4 good enough EIPT was chartered to:

- Coordinate the execution of the good enough program, now commonly called ABCS 6.4, at all Army levels.

- Serve as the focal point to ensure interoperability and programmatic synchronization among ABCS.

- Coordinate and interface with Army, Joint, and combined forums.

- Provide the SOS oversight on:
  - Integrated requirements;
  - Integrated architecture;
  - Integrated and synchronized program and execution schedule;
  - Project funding status;
  - Identification of issues and risk areas;
  - Risk mitigation plans and tracking;
  - Certification and evaluation status; and
  - Development of an Acquisition Program Baseline.

The biggest difference between previous ABCS versions and ABCS 6.4 is that it improves and automates data sharing and horizontal interoperability among the systems.

The EIPT quickly determined a high-risk area—the ABCS 6.4 schedule was very aggressive and success-oriented. A risk analysis showed that the software had to be very mature on entry to the Central Technical Support Facility (CTSF) in April 2004; however, there was no slack in the ABCS 6.4 good enough development, testing, training, and fielding schedule, and there was no time for materiel release approval prior to the first unit rotating into theater. A mitigation strategy was developed to separate the fielding and development process, and to field a previous version of ABCS to units deploying for Operation Iraqi Freedom (OIF).

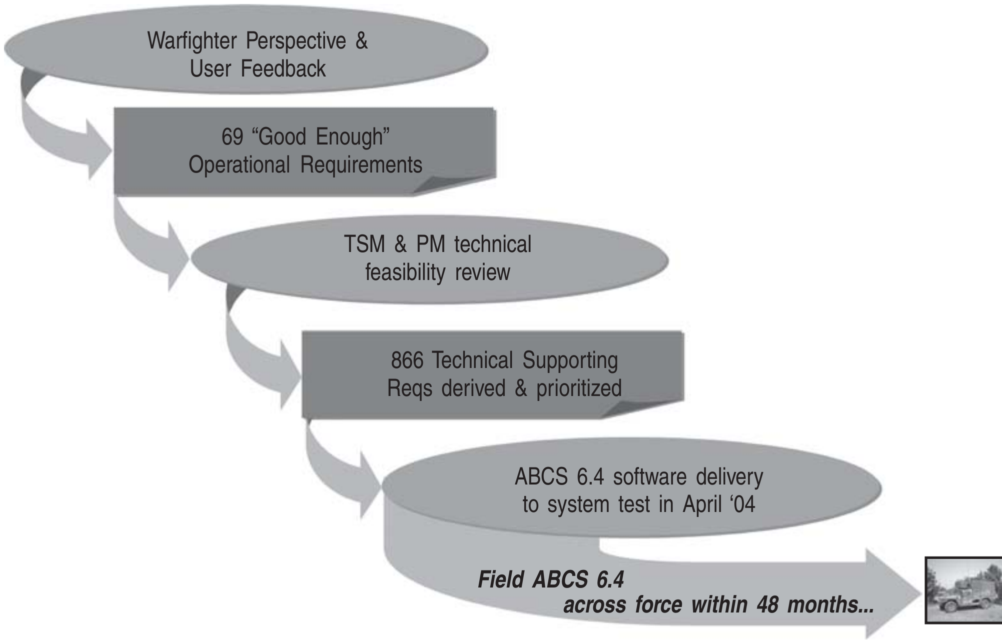

FIGURE 4. DEVELOPING THE ABCS 6.4 SOLUTION

DEVELOPING THE ABCS 6.4 SOLUTION

The ABCS 6.4 was designed to rapidly provide a good enough standard battle command capability across the Army based on the OIF lessons learned. The ABCS 6.4 brings together the BASs, integrating them as components in an interoperable SOS environment to enhance the commander's ability to command and control forces. Development of ABCS 6.4 is proceeding from the warfighter's perspective and incorporates user feedback that defines 69 operational good enough requirements. (See Figure 4.)

The biggest difference between previous ABCS versions and ABCS 6.4 is that it improves and automates data sharing and horizontal interoperability among the systems. To achieve a higher level of integration and interoperability, ABCS 6.4 will have an important feature that is new to ABCS called the Publish and Subscribe Server (PASS). The ABCS 6.4 core systems collectively operate in an SOS environment designed to provide the battle commander and staff with timely, accurate, and integrated mission-critical information to support effective command and control functions. This sharing of information across the network assists in providing the common operational picture—an important facet of digital battle command.

ABCS 6.4 DEVELOPMENT AND PROCESSES

The ABCS is being developed under the sponsorship of PEO C3T for the U.S. Army. Each component has its own program manager and developer, and they are

responsible for developing and testing all component functionality. The ABCS 6.4 EIPT immediately identified numerous issues and challenges in design, horizontal integration, scheduling, and time constraints. Some of the initial issues captured from the IPT kickoff meeting held in the fall of 2003 include:

- A needed mindset change from stovepipe development to an SOS.
- A need for a technical design review and the development of processes.
- The development of an SOS architecture.
- Schedule constraints with respect to system delivery, testing, and certification.
- A need for highly aggressive scheduling in fielding to the next OIF rotational unit.
- Identification of which OIF rotation, and what units, is ABCS 6.4 likely to be fielded to.
- Identification of a test unit and approval for coordination with the unit.
- A need for a coordinated schedule and plan for the engineering releases of C2 software that would lead to the final software submission by the target date of April 30, 2004.
- A need for strong coordination of the PASS Schema Library with all stakeholders.
- A need for feasibility proof of technical approach—use of PASS.
- Identification and resolution of bandwidth requirements and capabilities.
- Development of a critical path to the ABCS 6.4 Initial Operational Test (IOT) that includes:
  - Timing of software development and delivery to the CTSF;
  - Plan for interim software drops and testing;
  - Testing and certification timelines;
  - Plan and schedule for meeting documentation requirements;
  - Plan for unit new equipment training programs;
  - Plan for unit training, fielding, testing, and operational evaluation assessment, and;
  - Fielding Army-wide.

From this first meeting, the EIPT quickly identified issues and risk areas, started an effective tracking of program risks, and developed mitigation plans to reduce areas of significant risk. An integrated program schedule was developed, and a systems engineering design review was held—which would have been more effective if it had been conducted much earlier. However, immediate solutions to the integration problem

led to standardizing ABCS on Extensible Markup Language (XML), defining ABCS in commercial off-the-shelf compatible information architecture, and providing Web services through a publish and subscribe interface as the integration engine. With delivery of an AIS within a couple of months and coordination of the PASS Schema Library with all stakeholders, the EIPT worked toward finalizing the software delivery, testing, and certification schedule. The initial and primary focus of the EIPT was the development of the PASS XML data schemas and to formalize the emerging good enough architecture.

Several technical working groups were established to conduct the design review and resolve any discrepancies in understanding among the various stakeholders. The working groups were instrumental in finalizing a matrix showing which systems are publishing and/or subscribing, tied to specific schemas, and which are relying on messaging. All issues with the architecture and the data management schemas were fair game, and these working groups were critical in resolving issues on the spot. Participation of various stakeholders and agencies was highly encouraged, and working groups operated in open channels with no exclusions.

Significant issues arose in the SOS engineering as each program postured for optimum solutions for its program.

Other subordinate IPTs were formed to aggressively work the good enough issues in testing, training, programmatics, and logistics. Due to decentralization from working with 11 separate contracts, one important lesson learned was the need for a common set of reporting metrics to measure progress, and the need for it to be set up fairly early in an SOS environment. Through frequent and extensive high-level meetings, the EIPT received commitment from project and product managers for interim drops to the CTSF to alleviate schedule and integration risk. To lessen user concerns and earn their support, numerous briefings and presentations were given throughout the Army and to the DoD. The EIPT worked with Software Blocking initiatives, the Army Test and Evaluation Command (ATEC), and Department of the Army (DA) level agencies to coordinate activities. These meetings synchronized Army-wide efforts, resolved issues, and gained DA level guidance and support in working through the numerous documentation requirements.

Another significant lesson learned was the need for senior management's focus in the early phases of the project on the systems engineering. Significant issues arose in the SOS engineering as each program postured for optimum solutions for its program. The EIPT leader hosted weekly technical IPTs to mediate disputes and to keep the overall program moving forward until the software was delivered.

TESTING

Before certification and Intra-Army Integration Certification (IAIC) testing, the software is developed and tested under the sponsorship of its program or project manager. Each BAS is responsible for testing its own functionality; therefore, each has its own test plan. The BAS software is then released to all other BASs for development and incorporation in their respective software to ensure horizontal integration. Once this is complete, pairwise testing is performed with each BAS and the Foundation Software will occur. Upon completion of pairwise testing, the BAS software is delivered to the CTSF for integration as an SOS. One key and immediate task for the Technical IPT, in close coordination with the Test IPT (both supporting the EIPT), was the development of an integrated and synchronized schedule leading to the April 30, 2004, software drops to the CTSF. This was a significant lesson learned. The Test IPT was delegated to the CTSF and the EIPT initially did not give it enough attention. Also, the EIPT did not have buy in from the programs, nor detailed testing schedules. We never did get to pairwise testing.

Soldiers, the requirements community, material developers, product managers, industry, software programmers, engineers, technicians, the test community, trainers and combat systems all participated in the ABCS 6.4 testing.

After the software drop was made in April 2004, the battle command systems went though a test-fix-test cycle. The Development Test and Integration (DT&I), or test-fix-test phase of ABCS 6.4 software, was conducted at the CTSF in Fort Hood, Texas. This was intended as a unique testing window to afford the individual BASs the opportunity to come together as an SOS, and to test new interfaces, features, and functions prior to entry into certification testing. Operational threads form the basis of testing; however, these threads arrived after DT&I began and required numerous changes. When anomalies were found, the product managers, in close coordination with CTSF personnel, developed solutions on the spot. Following this test-fix-test, an IAIC test started in the fall of 2004. To conduct the IAIC test, a realistic model of the ABCS network was set up at the CTSF, and simulations of actual operations were run through the various systems. Soldiers, the requirements community, material developers, product managers, industry, software programmers, engineers, technicians, the test community, trainers, and combat systems all participated in the ABCS 6.4 testing.

The ABCS 6.4 SOS has completed the DT&I or test-fix-test phase successfully in terms of its ability to enter into certification. However, it entered into certification late and with several known issues. The most significant issues relate to thread development, test planning, collaboration, and data reporting and metrics.

After the formal integration testing at the CTSF, an ABCS 6.4 Test Event/Software Block One Operation Evaluation (SWB1 OPEVAL) will be conducted during a division training exercise under multiple Test and Evaluation Master Plans (TEMPs). All 11 ABCS core systems will be tested under realistic operational conditions with trained operators using the unit's standing operating procedures (SOPs) and tactics, techniques, and procedures (TTP). The purpose of this OPEVAL is to provide data for evaluating/measuring system effectiveness, suitability, and interoperability of the ABCS 6.4 core systems and available SWB1 equipment in a realistic operational setting. The ABCS 6.4 Test Event/SWB1 OPEVAL will focus on situational awareness, C2 messaging capabilities, message exchange, and critical mission threads of those BAS systems requiring a milestone decision. During the Test Event/SWB1 OPEVAL, soldiers will deploy and employ the ABCS 6.4/SWB1 systems predominately at division-, brigade-, and battalion-level command posts in accordance with the Army's new Heavy Division Modular Design/Architecture.

LESSONS LEARNED

Systems engineering was a big challenge, due to uncertainties in both technical and operational architectures, a highly compressed schedule, evolving technical design, and the need for synchronization across commands. Some initial issues were: SOS integration after the fact; undefined communications and network architectures; ABCS good enough not being in current Army documentation; operational requirements documents (ORDs) in various stages of approval (all had to be reworked); executing program development against ORDs in staffing; undeveloped Basis of Issue Plans (BOIPs); the need for operational architecture development for different levels of command (light and heavy brigades and divisions, Stryker Brigade Combat Teams [SBCTs], Corps, and units under the modularity concept); operational threads under development (and a need for global data formats), the need for a publish-and-subscribe matrix; and the mapping of publish-and-subscribe XML and threads to ORDs. Another major concern was executing programs against ORDs with potential modifications. Major changes to ORDs in the approval process would have broken good enough programs; however, this was mitigated through close coordination with Training and Doctrine Command (TRADOC); Headquarters, Department of the Army (HQDA) G3 Operations; and the Assistant Secretary of the Army (Acquisition, Logistics, and Technology) (ASA[ALT]).

The accelerated success-oriented schedule and diverse organizations made risk an inherent component of both ABCS as an SOS and on the ABCS 6.4 test program. This was further compounded by a lack of normal systems engineering process and documentation upfront. Having a well-defined and -documented testing policy is critical for the test, integration, and qualification activities. For a program with the scope and complexity of ABCS 6.4, it is imperative to develop a coordinated organizational plan from the beginning that addresses:

- Risk Identification.
- Risk Analysis.
- Risk Mitigation Planning.
- Risk Monitoring and Control.

Schedule and technical contingencies need to be aggressively monitored and managed. The ABCS 6.4 IPT found that the community was behind on test planning and had a test strategy in need of development. With less than a year until formal test certification, a test unit had not yet been identified, and the Army did not have a practical test plan. Additionally, the EIPT was working with a test timeline that was out of sync with Software Blocking, and a source of funds for FY04 test activities had not been identified.

LESSONS FOR THE COMMUNITY

BAS Centric versus SOS Focus. ABCS 6.4 good enough was moving from a loosely coupled architecture to a tightly coupled SOS architecture, but too often, issues and problems were perceived as individual software releases geared to stovepipe solutions. Horizontal integration was the driving force behind PASS; however, very few in the community, from developer to tester, perceived this as a single SOS release. Therefore, the main effort focused on horizontal integration and interoperability, horizontal network interface, and identifying and working through the bandwidth constraints. Additionally, the Training IPT was instrumental in addressing the lack of collective ABCS SOS training—both horizontal and doctrinal—and working with key leaders in getting buy-in of the total battle command capability.

Not having a well-defined systems architecture and the interface requirements upfront presented tremendous developmental and technical challenges.

After the Fact–Reverse System Engineering. Not having a well-defined systems architecture and the interface requirements upfront presented tremendous developmental and technical challenges. Without full product output from the systems engineering process, the metrics against which the SOS will be measured were not well-defined. Although each component within the SOS design is well-documented,

the SOS architecture and technical design as a whole is still being fine tuned, and this impacts the horizontal integration, interoperability, and resultant test cases.

Aggressive Schedule. There was a high level of risk directly attributable to no slack in the good enough schedule. Software had to be mature on entry to the CTSF in April 2004 to meet a targeted fielding for OIF 3. By the time it left the CTSF in the summer of 2004, it would have left 5 months to assess, train, and field the battle command and control system. Additionally, each system had to have an approved Materiel Release (MR) prior to the first unit rotating into country. Due to time constraints, this would have required urgent MRs. It became evident that the EIPT had to separate the fielding and development process. The EIPT was an excellent forum to address and focus developmental efforts in answering basic questions such as:

- What are the operational capabilities required for the system to reach good enough criteria?
- Of those capabilities, what can be met today without any additional software upgrades?
- Of the capabilities that cannot be met today, what is the added value of continuing with development?
- What is the timeline and investment strategy to reach MR?
- What are the ABCS and Joint dependency or interoperability issues?

It is difficult to improve what cannot be measured.

Metrics. Software quality, software improvement progress, organizational effectiveness, test effectiveness, and process improvement all have associated metrics. It is difficult to improve what cannot be measured. Binary evaluations of *pass* or *fail* do not facilitate improvement. While certification is a pass/fail environment, test-fix-test should always be one of measurement and improvement. The ISO/IEC 15939 discusses in some detail the measurement process in testing, and is a good starting place in understanding the needs for software, process, and test improvement. Evaluating and understanding common test metrics has traditionally been part of the commercial software industry in deciding when a product is ready to go to market, finding process issues, finding systems design issues, and measuring test effectiveness.

Operational Threads. While the threads developed for SWB1 were far more comprehensive than previously available, their accuracy, stability, and utility have to

be verified long before they are used to develop the technical solution. The process for approval and change is overly bureaucratic and cumbersome, and its utility as systems engineering documentation of ABCS 6.4 is doubtful if it does not conform to accepted commercial or government standards.

Management of Change. Because ABCS 6.4 good enough was not currently in Army documentation, it required extensive coordination across several Army organizations to manage the process. Additionally, change of this magnitude is a multi-year process that required *work-arounds* to mitigate risk to the overall program and compressed schedule. Most processes, such as safety certification, security documentation and approval, materiel releases, basis of issue plans, modified table of equipment updates, and institutional training packages, allow some sort of interim solution but require extensive coordination and open and frequent communications. On the plus side, a positive lesson learned was the importance of defining expectations through a senior leader review, which for this EIPT was weekly briefs or updates to the PEO C3T. The first senior leader review became a contract that all product managers understood and it contributed to all delivering on time.

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Much of the development effort behind ABCS 6.4 has been focused on improving interoperability between the different ABCS systems and on applying lessons learned about digital battle command from operations in Iraq. We must look for improvement in the ongoing cycle of developmental testing for ABCS SOS.

Below is a short list of actions to mitigate program risks:

- Design comprehensive system engineering upfront.
- Conduct a Business Process Reengineering study and develop a well-coordinated implementation plan.
- Conduct a well-developed system engineering design and review upfront.
- Develop and provide operational and technical architecture documentation with an SOS focus.
- Define roles and expectations of supporting agencies and required coordination and support of the other Services.

- Address assumptions and perceptions and identify dependencies.
- Initiate early and frequent discussions with all involved in the thread development process. (This is an important and critical step in merging system and operational views into one.)
- Initiate early discussions with Department of Operational Test and Evaluation (DOT&E) and service test agency stakeholders to identify testing requirements.
- Adhere to industry best practices and conformance with Army and Standards Organizations' guidance.
- Create Risk Management, Quality Management, and Communications Management Plans.
- Initiate early and continual coordination with the test community and service staff to deconflict and solidify testing, training, fielding, and unit schedules.
- Notify the Army leadership on testing, operational, funding, training, fielding, and sustainment issues on a frequent basis. (This was instrumental in getting DA level guidance and issue resolution across agencies.)
- Dedicate use of a separate Systems Integration Lab (SIL) for early integration, testing, and validation of fixes.
- Develop products and documentation with configuration management under the appropriate organization (TRADOC for the operational views [OVs] and PEO for the system views [SVs]).
- Consolidate and simplify the operational threads to bring them more in line with operational utility.
- Develop, publish, and institute a staff training program.
- Encourage participation by the developer, tester, trainer, and user in developing TTPs and SOPs. (This will assist users in implementing workarounds.)
- Develop a process to assist in getting it institutionalized, funded, integrated, and supported.
- Review and closely coordinate the operational thread process. Create operational and technical products that adhere to the DoD Architecture Framework (DoDAF). (With the OV products prepared well in advance, they can be traced back to the formal requirements documents and would more directly reflect the requirements. Likewise the SV and technical view (TV) products would better reflect the technical solution to the operational requirement.)

- Separate test executors from the test planners. (The Test IPT lead is needed outside of test community.)

- Put architectural products, as defined by the DoDAF, under appropriate Configuration Management (CM). (As a minimum, the Combat Developer should develop the required OV 1, 2, 3, 6c products and the materiel developer the SV 1, 2, 6 and 10c products. The SV products need to be developed and put under PEO CM and OV products developed under CM of TRADOC.)

- Develop a detailed Test Risk Management Plan. (A detailed quality plan and metrics that meets with current industry best practices should be developed for both test and SOS.)

- Conduct detailed systems engineering that is focused on the network-centric architecture for Net-Centric Warfare.

- Develop a reference implementation guide and repository containing a set of reusable software components. (It must describe how to reuse existing software and how to properly build new software so that integration is seamless and, to a large extent, automated.)

- Put in place an effective software infrastructure for supporting mission-area applications, a set of guidelines, and standards and specifications.

- Form a separate focused IPT for training. (Initially, it was part of the Logistics IPT but the volume of coordination with the user community and the development of numerous training products required the formation of a focused IPT for training.)

LEADERSHIP CHALLENGE

The designation of an ABCS 6.4 good enough trail boss led directly to the mitigation of leadership challenges. The effort required working with a diverse set of product managers who are not within the leadership chain, while at the same time supporting an Army at war. It was a new way of doing business. The IPT structure that was developed and implemented led to a common focus on developing good enough capabilities and fielding those capabilities now.

In addition to standardizing and determining a good enough Battle Command capability based upon findings from Operation Enduring Freedom (OEF)/OIF, the trail boss, through the EIPT, facilitated a change from a bottom-up to a top-down architecture focusing on the seven Critical Commander's Needs, defining guidance on development of the current software and enhancing the operational and technical architecture, and serving as a conduit for the reception and dissemination of evolving and emerging Army direction for the road ahead.

The EIPT was a successful synchronizing function. The extensive use of the EIPT allowed for rapid identification of issues with the appropriate tasking for resolving

technical issues on a very constrained timeline. By carefully monitoring and managing the system engineering process and deliveries, the program as a whole was able to make significant progress that was measured in weeks rather than months. The trail boss concept worked, and it allowed a coordinated transition of focus over time. The EIPT's major early effort was technical development with supporting planning efforts in logistics, training, and testing. Over time, the EIPT's priority transitioned to testing, then training, and now on logistics. A lesson learned, however, was that while the focus changes over time, all areas require some level of attention throughout the effort. During the early good enough development, attention to test planning was inadequate, leading to inefficiencies when formal testing began.

CONCLUSION

An operational assessment of the Army's Battle Command System was conducted by several Army agencies in theater. As a result, the Army requested that PEO C3T provide additional capabilities termed good enough. The PEO C3T and the ABCS 6.4 good enough EIPT worked hard to provide an architecture that is integrated across all mission-area command and control systems. This collaborative work effort has developed a good enough solution called ABCS 6.4; and in the spring of 2005, the ATEC will conduct an operational evaluation of ABCS 6.4 in terms of its good enough capabilities meeting commander's needs.

With the ongoing effort and emphasis on modeling and simulation to support SOS development, ABCS 6.4 will spiral technology in as it becomes available.

The trail boss concept worked and the EIPT was a success as a synchronizing function. In addition to providing current capabilities to the force, the current developmental efforts will further position ABCS 6.4 in supporting the Army's Objective Force. The PEO C3T is currently conducting an extensive review of our basic system engineering and integration processes that continues its focus on the FCS SOS. Because information technology will not sit still, good enough is in fact *not* good enough. It is recognized that if the capability is not provided, the warfighter will get it himself. With the ongoing effort and emphasis on modeling and simulation to support SOS development, ABCS 6.4 will spiral technology in as it becomes available. Spirals down the road in support of the Joint Tactical Common Operational Picture (JCOP) Workstation include getting on a common maneuver baseline with the U.S. Marine

Corps and Command Post of the Future (CPOF) to provide joint collaboration. This system engineering review will examine how the PEO can better support joint interoperability throughout the software production lifecycle.

The EIPT is a good tool for developing innovative approaches to build interoperable systems. The PEO C3T is better served by using the ABCS 6.4 EIPT's strong infrastructure to provide a more dynamic and flexible organization that will work through the complex issues as it develops, tests, trains, and fields the Army's net-centric battlefield command and control system. A brief description of each battlefield functional area system is found in the Appendix.

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APPENDIX
ABCS 6.4 NETWORK BATTLEFIELD FUNCTIONAL AREA SYSTEMS

Advanced Field Artillery Tactical Data System (AFATDS) – The AFATDS provides the multi-Service (Army and U.S. Marine Corps) automated Fire Support Command, Control, and Communications portion of the Army Battle Command System (ABCS). The AFATDS enables the maneuver commander to plan and attack using the optimal weapon-target pairing combinations. AFATDS provides integrated automated support for planning, coordinating, and controlling all fire support assets (field artillery, mortars, close air support, naval gunfire, attack helicopter, and offensive electronic warfare) and for executing counterfire, interdiction, and suppression of enemy targets.

Air and Missile Defense Planning and Control System (AMDPCS) – The AMDPCS provides air defense planning, monitoring, and air battle management capabilities. It integrates air defense (AD) fire units, sensors, and C2 centers into a coherent system capable of defeating or denying the aerial threat.

AIS/Foundation Products – The ABCS Information Server (AIS) acts as an information hub, providing critical data to the Battlefield Functional Areas (BFAs) to include alerts, messaging, communications, and address books.

All-Source Analysis System (ASAS) – The ASAS is the ABCS intelligence fusion system that provides a timely, accurate, and relevant picture of the enemy situation to warfighters. It provides combat leaders all source intelligence to support visualization of the battlefield and so support more effective conduct of the land battle. The system capabilities allow the soldier to collaborate with other systems, process and analyze all source intelligence, support non-structured threat analysis, provide predictive analysis, produce a correlated ground picture, disseminate intelligence products, and provide target nominations. It also supports management of intelligence, surveillance, reconnaissance assets, intelligence collection, provision of Combat Intelligence/Operations Security (CI/OPSEC) mission support, provision of electronic warfare support, and force protection. The ASAS interoperates with organic Intelligence and Electronic Warfare (IEW) sensors; ABCS, Joint, Theater, and National sensors and preprocessors; as well as other Service intelligence processors. The ASAS Light (ASAS-L) will be the chief intelligence fusion platform at corps and division echelons in the ABCS-equipped units.

Battle Command Sustainment Support System (BCS3) – The BCS3 is the Army's maneuver sustainment C2 system that provides a concise picture of unit logistical requirements and support capabilities. It provides a running estimate of evolving logistics situations including assessments of current and future combat power that is essential for warfighters to assess their unit's capability to complete their mission.

The BCS3 integrates the logistics common picture maintaining and generating CSS feeds to the running estimate requirement as well as bringing in-transit visibility to the running estimate by assessing the impact of “dues in” on the current situation, enabling the warfighter to view material in the logistics pipeline. This is key to the accuracy of the running estimates (i.e., projecting changes in asset status in 24-, 48-, and 72-hour representations).

Digital Topographic Support System (DTSS) – The DTSS provides automated support for terrain mapping and analysis and creation of topographic products within the timeframes required by today’s Army. It provides geospatial data generation, collection, and management; geospatial information processing, presentation, and analysis; and engineer survey and map reproduction needs for command and control terrain visualization.

Force XXI Battle Command Brigade-and-Below (FBCB2) – The FBCB2 supports the control and coordination of forces down to the platform level (individual vehicle or aircraft). It provides the common picture, decision aids, and overlay capabilities to support tactical commanders and staffs, and provides links from the lowest echelons into the other ABCS systems. This information is available in near-real time and provides units the capability to transmit key combat information rapidly through formatted digital messages.

Global Command and Control System—Army (GCCS-A) – The GCCS-A is the Army’s strategic and theater command and control system. It provides readiness, planning, mobilization and deployment capability information for the strategic commanders. For theater commanders, GCCS-A provides Common Operational Picture (COP) and associated friendly and enemy status information, force employment planning and execution tools (receipt of forces, staging, intra-theater planning, readiness, force tracking, onward movement, and execution status), access to GCCS applications for users with the appropriate permissions, and overall interoperability with Joint, Coalition, and other ABCS Battlefield Automated Systems (BASs).

Integrated Meteorological and Environmental Terrain System (IMETS) – The IMETS provides weather analysis to commanders at all echelons with an automated tactical weather system that receives, processes, and disseminates weather observation forecasts, battlefield visualization, and weather effects decision aids to all BASs.

Integrated System Control (ISYSCON) Version (V)4 – The ISYSCON (V)4 provides communications system network management, control, and planning. The ISYSCON (V)4, also known as the Tactical Internet Management System (TIMS), provides network initialization, local area network (LAN) management services, and an automated system to support the combat net radio-based wide area network.

Maneuver Control System (MCS) – The MCS gives commanders and staffs the ability to collect, coordinate, and act on near-time battlefield information and graphically visualize the battlefield. The MCS integrates information horizontally and vertically to provide the common picture of friendly and enemy unit locations. As the primary automated tool for commanders and staffs from corps to battalion level, it is relied on to provide the Common Operational Picture, decision aids, and facilities for development and dissemination of plans and orders.

Tactical Airspace Integration System (TAIS) – The TAIS provides automated support for Army Airspace Command and Control (A2C2) and Air Traffic Services (ATS) operations. The TAIS supports A2C2/ATS operations from Echelons Above Corps (EAC) down to the division level (and below when task-organized for such roles). In the A2C2 role, TAIS provides automated and digitized A2C2 planning, coordination, and execution of the third dimension of Army battlespace. In the ATS role, it will support the Theater, Corps, Divisions, and Task Forces (as necessary). It provides theater and intra- and inter-Corps/Division ATS support in war, and provides a versatile airspace management system for military operations other than war (MOOTW). The TAIS interfaces with joint, combined, civil, and military airspace control agencies and their airspace management systems.